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Urceolariidae of molluscs of the Baltic Sea

Urceolariidae mięczaków Bałtyku

The widely distributed and highly differentiated genus *Trichodina* has relatively few representatives found in the *Mollusca;* they are: *T. baltica* Quennerstedt, 1869, *T. achatinae* Fantham, 1924, *T. cardii* Delphy, 1938, *T. tegula* Hirshfield, 1949, *T. myicola* Uzmann et Stickney, 1954 and *T. unionis* Hampl, 1955. In the *Mollusca* of the Polish part of the Baltic Sea the following forms could be expected: *T. cardii* Delphy, *T. myicola* Uzm. et Stick., and *T. baltica* Quen., because their hosts occur in our waters; only *T. baltica* Quen. was described from the Baltic Sea.

In our studies conducted during the summer months of 1957 and 1958 we examined hundreds of molluscs collected from the Gulf of Puck, Gulf of Gdańsk and South Baltic. The *Mollusca* belonged to the following species: *Mytilus edulis* L., *Cardium edule* L., *Macoma baltica* L., *Mya arenaria* L., *Hydrobia ventrosa* Mont., *H. jenkinsi* Sm., *Theodoxus fluviatilis* L., *Limnaea ovata baltica* Nilss. The following species of *Urceolariidae* were found in them: *T. baltica* Quennerstedt, 1869 in *Theodoxus fluviatilis, Hydrobia* sp. sp. and *Limnaea ovata baltica, T. macomarum* sp. n. in *Macoma baltica, T. cardiorum* sp. n. in *Cardium edule, T. domerguei* f. *cardii* f. n. in *Cardium edule.*

In spite of intense searching we did not succeed in finding the occurrence of the representatives of the genus *Trichodina* neither any other *Urceolariidae* in *Mya arenaria* and *Mytilus edulis.*

The material was studied in vivo, on preparations stained with iron hematoxylin and above all in silver nitrate impregnated preparations according to B. Klein's method. The representatives of the separate populations of *Trichodina* were measured and com-

pared on series of tens of microphotographs taken of silver nitrate impregnated preparations. The enclosed figures of the silver-nitrate impregnated specimens of the separate species of *Trichodina* represent them at the same magnification, as accurately as possible and by the avoidance of making schemes.

Trichodina baltica Quennerstedt, 1869

Quennerstedt (1869) presented a description of *T. baltica* from *Neritina fluviatilis* of the Baltic Sea at Visby and differentiated it distinctly from „*T. pediculus*" from *Gasterosteus* that is from *T. domerguei* f. *latispina* Dogiel, 1940 (vide Raabe, 1959). Both the description and the figures (No. 24—29) and above all (in view of the lack of certain data in the description) the occurrence on the same species of snail, entitle us to identify with this species the *Trichodina* found by us constantly in the mantle cavity of *Theodoxus fluviatilis* in 1937 and 1938 both in the Żarnowieckie Lake, Pomerania and in the Gulf of Gdańsk near Hel, during 1955 and 1956 in the Vistula Bay, and again in 1957 and 1958 in the Gulf of Gdańsk and Gulf of Puck. We found constantly *T. baltica* in great numbers in *Theodoxus fluviatilis*, infected almost in 100% of cases, whereby we observed it only in saltish water or reservoirs of freshwater which remained in contact with the sea (as the Żarnowieckie Lake), but we did not notice its occurrence in *Theodoxus* from rivers and other typical fresh-water bodies. Besides Quennerstedt and the authors of the present paper, *T. baltica* is reported by Precht, 1935 of *T. fluviatilis* from the Kieler Bucht.

Table I

Trichodina baltica Quen. — fluctuations of the number of denticles

	No. of denticles:	21	22	23	24	25	26	27	28	29	30
Theodoxus fluviatilis	Gulf of Gdańsk		2	4	23	41	19	7	3	1	
	The Vistula Bay			2	3	7	4	12	6	4	
			6	8	3	1	1	1			
	The Żarnowieckie Lake	1	3	5	10	19	18	27	10	7	
			8	24	21	11	13	14	9		
Hydrobia sp. sp.	Gulf of Puck				3		7	3	1		1
Limnaea ovata	Gulf of Puck	2	2	5	3	7	6		1		

In the course of our studies extended in 1957 and 1958 on other molluscs of the Baltic Sea and its gulfs we found very close *Trichodina* in the mantle cavity of *Hydrobia ulvae, H. jenkinsi* and *Limnaea ovata baltica* of the Gulf of Puck. In spite of certain, quite insignificant differences in the outline of the hooks (Fig. 1), num-

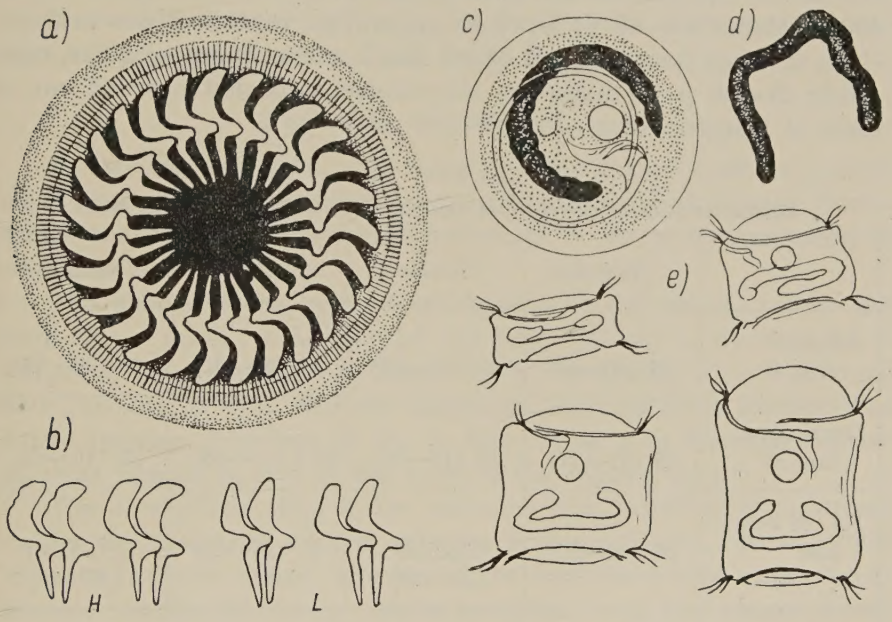

Fig. 1. *Trichodina baltica* Quen. a — the oral side, $AgNO_3$, × 1200; b — the denticles of individuals from *Hydrobia* sp. sp. (— H) and *Limnaea ovata baltica* (— L); c — from the oral side, I. H., × 600; d — nuclear apparatus, I. H, ×600; e — various forms of body.

ber of links of the denticulate ring etc. we are of the opinion to regard the *Trichodina* of these molluscs as *T. baltica* Quen. The existing differences do not entitle even to differentiate separate forms within this species. They are shown in Table I and II.

The especially strong infection of *Theodoxus fluviatilis,* and the rare and very mild infection of the remaining snails is an indication, that *Theodoxus* is the main, typical host of *T. baltica* Quen., the remaining snails are therefore accessory, secondary hosts.

The shape of the body, particularly that of the forms from *Theodoxus fluviatilis,* is extremely variable: from a flat disk to a high cylinder; the height of the cylinder is considerable larger than the diameter. In the individual specimens of *Theodoxus* there occur

either in preponderance the large and high forms, or the small and flat ones, or the population is mixed or finally it is of intermediate character. In *Hydrobia ventrosa, H. jenkinsi* and *Limnaea ovata baltica* occur in the whole the intermediate forms. The diameter of the body 30—60 μ, average 45 μ; height 15—70 μ. Diameter of the adoral spiral describing as in all *Trichodina* an arc of about 400°, attains 27—45 μ. Nuclear apparatus: macronucleus sausage--like, in large forms almost coiled like a snake in an irregular, open circle 22—50 μ in diameter; micronucleus located near of one of ends of macronucleus.

Table II

Characteristics of *Trichodina baltica* Quen. from various hosts

	Hydrobia	*Theodoxus*	*Limnaea*	totally
Adhesive disk Ø	45 (40—48)	43 (32—55)	41 (30—52)	43 (30—55)
Denticulate ring Ø	25 (21—27)	25 (16—31)	22.5 (17—28)	24 (16—31)
No. of denticles	26 (24—30)	23;25;27 (21—29)	25 (21—28)	23;25;26; (27—30)
Length of hooks	6.5—8	6—7	4—7	4—8
Length of spikes	5—7	6.5—7.5	4—7.5	4—7.5

The denticulate ring of the adhesive disk consists of denticles provided with long, slightly curved, narrower near the end and round on the terminals extrorse hooks and also long, straight introrse spikes which become slightly narrower at the terminals. In the populations from *Hydrobia* sp. sp. the narrowing of the hooks at their terminals is least marked, in populations from *Limnaea* — most. The spikes reach fairly far towards the centre of the adhesive disk and leave a free disk 6.5—14 μ in diameter, which appears in silver-nitrate preparations dark, similarly as the space between the spikes. The number of denticles of the denticulate ring fluctuates from 21 to 30, whereby in various populations the

dominating numbers are 23, 25, 26 or 27 (Table I and II); diameter of the adhesive disk 30—54 μ, average 43 μ; diameter of the denticulate ring 16—30 μ, average 25 μ; length of hooks counted from the centre of the denticle 4—8 μ, length of spikes also 4—8 μ. Number of striae on the periphery of the adhesive disk, corresponding to one denticle of the denticulate ring, is 8.

Numerical data referring to the populations from various species of hosts are shown in Table I and II.

Trichodina macomarum sp. n.

T. macomarum sp. n. was found by us relatively not frequently in *Macoma baltica* from various spots of the Gulf of Gdańsk. Sometimes the infection was fairly numerous — 20 to 30 specimens in one mollusc.

The shape of the body characteristic to the genus, rather flat and like a plate. Diameter of the body 50—65 μ, average 60 μ, height ± 20 μ. Diameter of adoral spiral, describing an arc of about 400°, attains ± 45 μ. Nuclear apparatus: macronucleus sausage-like, fairly regular, describes an arc ± 320°, ± 40 μ in diameter; micronucleus located at one of the ends of the macronucleus.

The denticulate ring of the adhesive disk provided with strong, rather declined than curved extrorse hooks and long, on the whole straight introrse spikes. The hooks are well developed of a characteristic hatchet-like shape: their marginal rims run almost parallelly, and the ends are straightly cut; however, specimens were found with hooks of irregularly indented rims. The spikes may often be of an uneven length, sometimes they appear as being broken out and in many specimens they are irregularly twisted. In relation to the length of spikes and relatively small diameter of the denticulate ring, the central part of the adhesive disk free from spikes is relatively not large, 7—14 μ in diameter; the proportion of its diameter to the diameter of the denticulate ring is 1 : 2.8 (while in *T. cardiorum* it is 1 : 1.6). In silver nitrate impregnated preparations this field is dark, but on the dark background there are present peculiar light spots in the shape of rods or spindles.

The number of denticles of the denticulate ring fluctuates between 20 to 27, most commonly there appear 22 or 23. Diameter of the adhesive disk measures 42—59 μ, average 50 μ; diameter of the denticulate ring 21—33 μ, average 25.5 μ; length of hooks counted from the centre of the denticle 6—7 μ, length of spikes 6—8 μ. Num-

ber of striae on the periphery of the adhesive disk, corresponding to one denticle of the denticulate ring is about 10.

Trichodina macomarum sp. n. differs markedly from other species by its characteristics, as above all by: the structure of the denticulate ring, hooks and spikes, specific character of the central part of the adhesive disk and by the specific proportions and dimensions. This entitles us to diagnose *Trichodina macomarum* sp. n. as a separate, good species, specific as apparent to *Macoma baltica*.

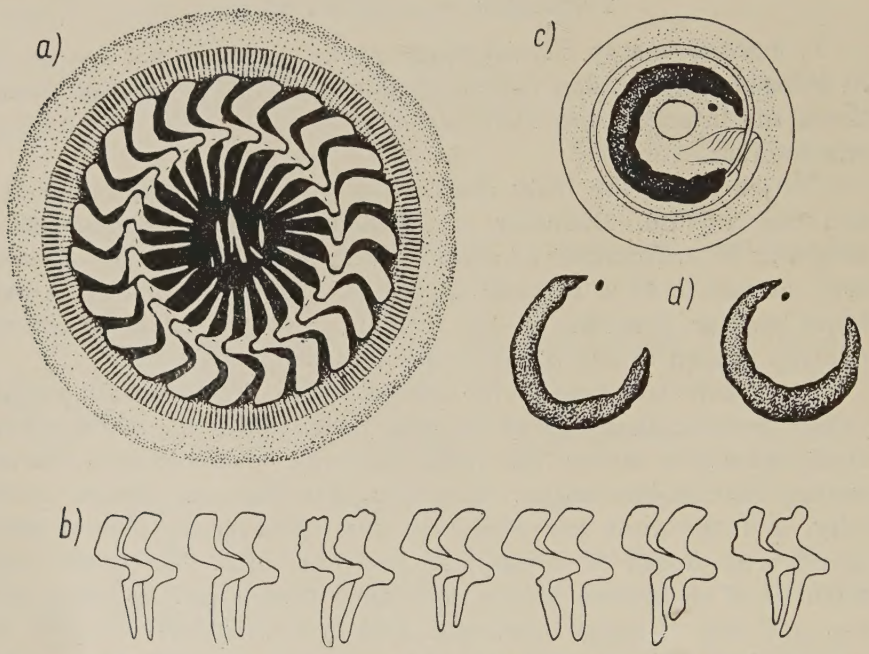

Fig. 2. *Trichodina macomarum* sp. n. a — the aboral side, $AgNO_3$, × 1200; b — various forms of denticles; c — from the oral side, I. H., × 600; d — nuclear apparatus, I. H., × 600.

Trichodina cardiorum sp. n.*

T. cardiorum sp. n. was found by us in the mantle cavity of *Cardium edule*, exclusively in very young specimens, measuring up to 5 mm, most commonly, however, in still smaller specimens mea-

* Delphy (1938) signalized of the finding in the mantle cavity of *Cardium* of a species of *Trichodina*, which appeared to be to him new and was named by him *Cyclochaeta cardii*. Delphy's work shows the author's complete inexperience with the protozoa material, a marked lack of technic

suring 2—3 mm. It is significant that we never found *T. cardiorum* sp. n. in *Cardium* of larger dimensions not even when the specimens were in one population with the small specimens infected. We found *T. cardiorum* sp. n. in molluscs collected from dispersed popu-

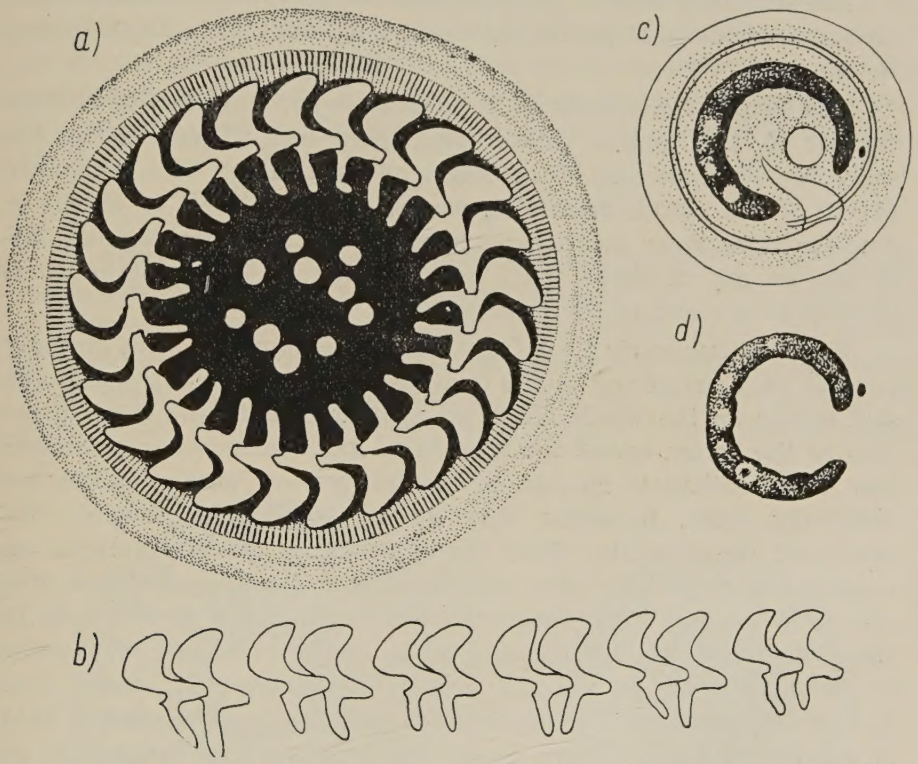

Fig. 3. *Trichodina cardiorum* sp. n. a — the aboral side, $AgNO_3$, × 1200; b — various forms of denticles; c — from the oral side, I. H., × 600; d — nuclear apparatus, I. H., × 600.

lations in the area of Kuźnica on Hel, close to the passage by which the more salty water of the Gulf of Gdańsk enters the Gulf of Puck.

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and a complete disregard of rules respected in taxonomy. In addition, Delphy's drawings are on a very low level and similarly to the laconic and unreal descriptions or complete lack of descriptions they make it entirely impossible to get orientated not only as regards the species but also as regards the higher taxonomical units dealt with by the author. Taking this into consideration, also the name „*Cyclochaeta cardii* Delphy", given without a description should be regarded as nomen nudum. This is necessary because we found in *Cardium edule* two species of *Trichodina*, therefore it is not known with what form dealt Delphy.

It is characteristic that in other areas of the Gulf of Puck, namely in the parts containing more fresh-water as the case is near Rewa and Swarzewo — *T. cardiorum* sp. n. was replaced (even in very small *Cardium*) by *T. domerguei* f. *cardii* f. n.

The infection was in some populations of young *Cardium* fairly frequent, about 50% but on the whole not large: up to 25 specimens in one host.

The shape of the body of *T. cardiorum* sp. n. generally characteristic to the genus, rather flat, plate-like. Diameter of the body 54—90 μ, average 75 μ; height of the body ± 20 μ. Diameter of the adoral spiral, describing an arc of about 400°, is 45—65 μ. Nuclear apparatus: macronucleus sausage-like, fairly regular, describes an arc of about 300°, the diameter ± 45 μ; micronucleus located at one end of the macronucleus.

The denticulate ring consists of denticles provided with strongly curved, very broad and at the ends slightly rounded extrorse hooks and strong on the whole short, straight or bent in the same direction as the hooks, broad and truncheon like broadened introrse spikes. The denticulate ring is on the whole very ample, spikes are relatively short, therefore they do not extend far towards the centre of the adhesive disk; therefore in its centre remains an exceptionally spacious area without spikes; its diameter measures 16—26 μ, average 22 μ. Proportion of the diameter of this area to the diameter of the denticulate ring is on the average 1 : 1.6 (while in *T. macomarum* it is 1 : 2.8 and in *T. domerguei* f. *cardii* f. n. 1 : 3.7). On silver nitrate impregnated preparations the central field of the adhesive disk is dark as are arears between the spikes, but as a rule there appear in the central field spherical or oval light spots, several or over ten. Their occurrence in *T. cardiorum* sp. n. is very constant and characteristic, similarly as characteristic to *T. macomarum* sp. n. is the occurrence of rod-like structures.

The number of denticles of the denticulate ring fluctuates from 24 to 29, most commonly it is 25 (exceptionally in one case 35!). Diameter of the adhesive disk measures 53—68 μ, average 60 μ; diameter of the denticulate ring 30—41 μ, average 36 μ; length of hooks counted from the centre of the denticle 6—7.5 μ, length of spikes also 6—7.5 μ. Number of striae on the periphery of the adhesive disk corresponding to one denticle of the denticulate ring 10—11 (exceptionally in a specimen with 35 denticles — 9).

Trichodina cardiorum sp. n. is differentiated from other species by its characteristic morphological picture: structure of the vast denticulate ring, hooks and spikes, by the character of its central part of the adhesive disk and by its biometrical characters. It is differentiated also clearly from *T. domerguei* f. *cardii* f. n. occurring in the mantle cavity of *Cardium edule*, what is shown in the description of this form, and from *T. macomarum* sp. n. This entitles us to diagnose *T. cardiorum* sp. n. as separate species, specific as apparent to *Cardium edule* from the waters of the Baltic Sea.

Trichodina domerguei f. *cardii* f. n.

T. domerguei was found by us in the mantle cavity of very small specimens of *Cardium edule*, living, however, in other areas and environments than those, in which *T. cardiorum* sp. n. was found. The molluscs infected with *T. domerguei* were usually collected from large and dense populations living in parts of the Gulf of Puck, which contain more fresh-water, namely from subwater areas

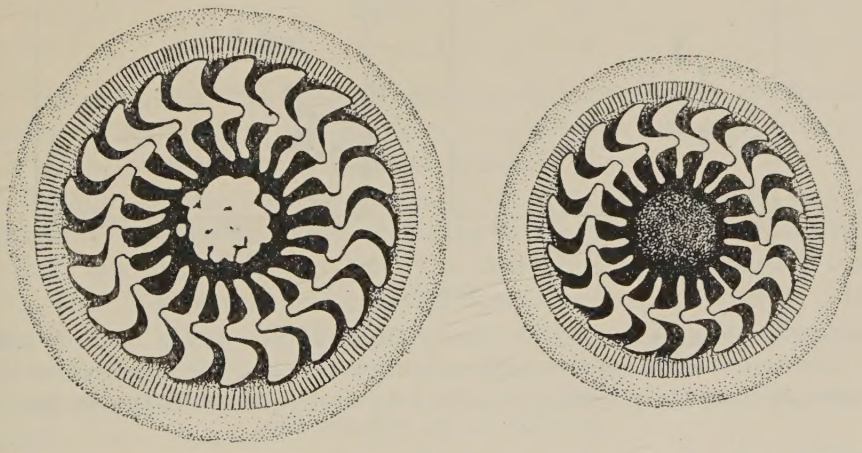
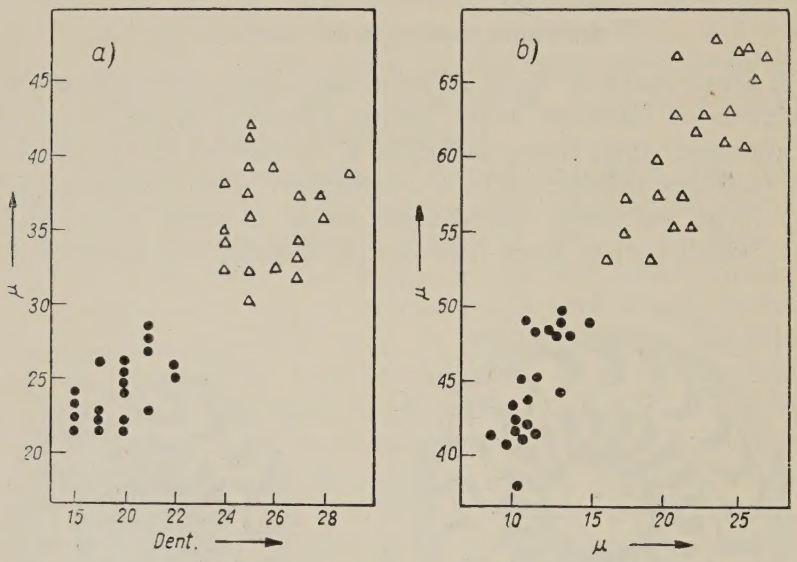


Fig. 4. *Trichodina domerguei* f. *cardii* f. n. — the aboral sides, $AgNO_3$, × 1200.

of sea-weeds near Swarzewo and from a small bay near Rewa. This distribution of the molluscs infected with *T. domerguei* seems to us to be characteristic; similarly characteristic seems to be also the fact, that *T. cardiorum* sp. n. occurs in *Cardium* from the dispersed population in the area of Kuźnica, where the access of salty water is markedly stronger.

T. domerguei from *Cardium edule* constitute a separate form, closely standing to *T. domerguei* f. *latispina* D o g i e l, which occurs in *Gasterosteidae, Syngnathidae* and also in other fishes of the Baltic Sea (Z. R a a b e, 1958, 1959). The specimens from *Cardium* are from the former somewhat smaller and are provided with a smaller number of denticles of the denticulate ring; from the second Baltic form, *T. domerguei* f. *gobii* R a a b e, 1959 it differs by larger dimensions and greater number of denticles. Therefore we are describing it as a new form: *T. domerguei* f. *cardii* f. n.



Diagram

Trichodina cardiorum sp. n. (△) and *Trichodina domerguei* f. *cardii* f. n.(●): a — relation between the number of denticles and the diameter of the denticulate ring; b — relation between the diameter of the inner area and the diameter of the adhesive disk.

Shape of the body characteristic for the species; diameter 38——50 μ, height ± 20 μ, adoral spiral ± 36 μ in diameter. Nuclear apparatus: macronucleus sausage-like, of a fairly regular outline, describes an arc of about 300°, the diameter ± 30 μ; micronucleus located at one of the ends of the macronucleus.

The denticulate ring of the adhesive disk consists of denticles provided with broad sickle-fashion curved apically slightly rounded extrorse hooks and slightly curved, relatively thick introrse spikes.

The hooks vary in numbers between 18 to 22, most commonly there are 20 or 21. Diameter of the adhesive disk 38—50 μ, average 45 μ; diameter of the denticulate ring 21—28μ, aveage 25μ; length of hooks counted from the centre of the denticle 4.5—6.5 μ, length of spikes 4—6.5 μ. Number of striae on the periphery of the adhesive disk, corresponding to one denticle of the denticulate ring is 10. In silver-nitrate impregnated preparations the centre of the adhesive disk is often clearly bright and sharply outlined against the zone occupied by the spikes (as in other forms of *T. domerguei*), however, quite often (commoner than in the forms from fishes) the bright zone is divided into several smaller zones, or even strongly darkened.

T. domerguei f. *cardii* f. n. is well differentiated from *T. cardiorum* sp. n. by its morphological characters: dimensions, different character of the central zone of the adhesive disk, its size and biometric data (diagram 1); howewer, it is allied to *T. cardiorum* sp. n. by the shape of hooks and spikes. Species separateness of the two forms appears to be beyond doubt.

General notes

The species of the genus *Trichodina* found by us in the mantle cavity of *Mollusca* of the Baltic Sea show very essential differences in their specificity in relation to hosts.

Totally specific according to our present studies seem to be two species: *T. cardiorum* sp. n. occurring in very small *Cardium edule* and *T. macomarum* sp. n. from the mantle cavity of *Macoma baltica*. They are in our opinion good species and show both in relation to each other and to other known forms of the genus *Trichodina* marked differences of the species grade. In our opinion it seems doubtful that any one of the two species could pass on other hosts.

A broad group specificity in relation to salty-water *Gostropoda* shows *T. baltica* Q u e n. the most typical to *Theodoxus fluviatilis*. Its populations occurring in *Hydrobia* sp. sp. and in *Limnaea ovata baltica* differ biometrically from populations from a typical host not more, than do the separate populations from *Th. fluviatilis* between themselves. This prevents even to differentiate separate „forms" from different hosts.

Finally the least specific is *T. domerguei* (W a l l.), occurring on freshwater and sea fishes, on tadpoles of *Anura*, and in our mate-

rial found in *Cardium edule*. Out of the numerous forms of this species in the Baltic Sea occurs the ubiquitous, large *T. domerguei* f. *latispina* Dogiel. *T. domerguei* f. *cardii* f. n. found in *Cardium* is very closely allied to those forms, however it differs from them by biometric characters and the less uniform bright zone in the centre of the adhesive disk.

A detailed discussion is required as regards the relation of *T. domerguei* f. *cardii* f. n. to *T. cardiorum* sp. n. The separateness of the two forms seems to be distinct (see the discussion following the descriptions), characteristic is also the ability to replace themselves in *Cardium edule* from various environments, therefore there appears to be a certain ecological vicariousness. On the other side their similarity rises no doubt, particularly in respect to the structure of the denticles. It is possible to say that *T. domerguei* f. *cardii* f. n. deviates from the typical forms of *T. domerguei* (Wall.) in the direction, which leads somehow to *T. cardiorum* sp. n. Therefore it can be supposed, that *T. domerguei* f. *cardii* f. n. is a form of the ubiquitous species *T. domerguei*, which gained a new host — *Cardium edule* and that *T. cardiorum* sp. n. is a species originating from this form, proper to more salty waters, well differentiated from it, but still to a certain degree connected with it. However, this problem requires still further studies.

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STRESZCZENIE

Autorzy podają wyniki swych badań nad *Urceolariidae* mięczaków Bałtyku, a przede wszystkim Zatoki Gdańskiej, Zatoki Puckiej i Zalewu Wiślanego. W zebranym materiale wyróżniają następujące gatunki:

Trichodina baltica Quennerstedt, 1869 z *Theodoxus fluviatilis* L., *Hydrobia* sp. sp. i *Limnaea ovata baltica* Nilss.

Trichodina macomarum sp. n. z *Macoma baltica* L. Zatoki Puckiej i Zatoki Gdańskiej.

Trichodina cardiorum sp. n. z drobnych *Cardium edule* L. z bardziej słonych miejsc Zatoki Puckiej.

Trichodina domerguei f. *cardii* f. n. z drobnych *Cardium edule* L. z bardziej wysłodzonych miejsc Zatoki Puckiej.

Autorzy rozważają sprawę mniejszej lub większej specyficzności znalezionych form w stosunku do żywicieli, zwracając uwagę na zastępowanie się w różnych warunkach ekologicznych *T. cardiorum* sp. n. i *T. domerguei* f. *cardii* f. n.